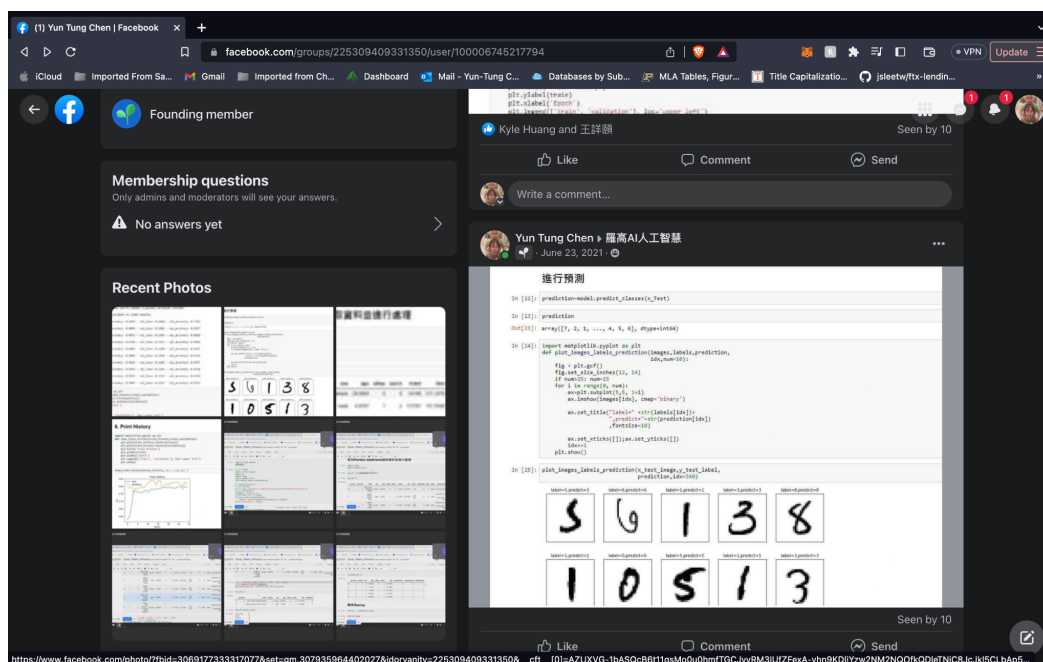


### Previous Work from High school

Overview: I took a ML class in high school in 2021 and we were mainly focusing on learning how to use the model to recognize handwritten numbers. All the photos below were records I posted in the class's facebook group after class during that year as records of my learning and notes to review from. Below are the pictures. We have 18 pages in total.



### 進行預測

```

In [22]: prediction=model.predict_classes(x_Test)

In [23]: prediction

Out[23]: array([7, 2, 1, ..., 4, 5, 6], dtype=int64)

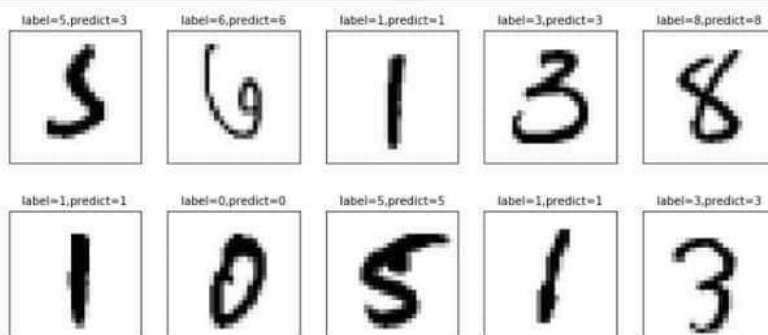
In [24]: import matplotlib.pyplot as plt
def plot_images_labels_prediction(images,labels,prediction,
                                idx,num=10):
    fig = plt.gcf()
    fig.set_size_inches(12, 14)
    if num>25: num=25
    for i in range(0, num):
        ax=plt.subplot(5,5, 1+i)
        ax.imshow(images[idx], cmap='binary')

        ax.set_title("label="+str(labels[idx])+
                    ",predict="+str(prediction[idx])
                    ,fontsize=10)

        ax.set_xticks([]);ax.set_yticks([])
        idx+=1
    plt.show()

In [25]: plot_images_labels_prediction(x_test_image,y_test_label,
                                prediction,idx=340)

```



Prediction for the numbers

## 使用Pandas dataframe讀取資料並進行處理

```
In [3]: import numpy
import pandas as pd
```

```
In [4]: all_df = pd.read_excel(filepath)
```

```
In [5]: all_df[:2]
```

```
Out[5]:
```

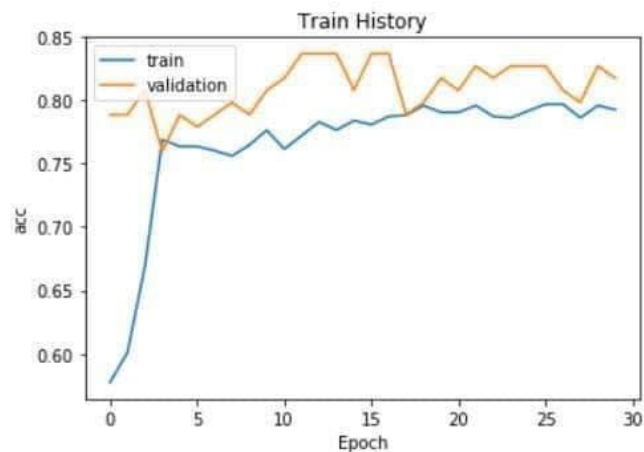
	pclass	survived	name	sex	age	sibsp	parch	ticket	fare	cabin	embarked	boat	body	home.dest
0	1	1	Allen, Miss. Elisabeth Walton	female	29.0000	0	0	24160	211.3375	B5	S	2	NaN	St Louis, MO
1	1	1	Allison, Master. Hudson Trevor	male	0.9167	1	2	113781	151.5500	C22 C25	S	11	NaN	Montreal, PQ / Chesterville, ON

Using panda to read in files

## 6. Print History

```
In [15]: import matplotlib.pyplot as plt
def show_train_history(train_history, train, validation):
    plt.plot(train_history.history[train])
    plt.plot(train_history.history[validation])
    plt.title('Train History')
    plt.ylabel(train)
    plt.xlabel('Epoch')
    plt.legend(['train', 'validation'], loc='upper left')
    plt.show()
```

```
In [16]: show_train_history(train_history, 'acc', 'val_acc')
```



Print out the history

錄製 中賴政良正在分享螢幕畫面

Google Meet x Meet - bmm x (1) 蘇萊AI人工智慧 x Dropbox - 蘇萊 - x Home Page - Sele x Keras\_Taianic\_Intro x

localhost:8888/notebooks/Keras\_Taianic\_Introduce.ipynb

應用程式 常用連結 程式設計 發明家 第一篇 ESP32 Ardu... 通过串口连接REPL... ESP32(Arduino) @... Raspberry使用L29... 109

jupyter Keras\_Taianic\_Introduce Last Checkpoint: 2020年12月13日 (autosaved)

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3

Run Code

```
In [2]: import urllib.request
import os

In [36]: # 匯入所需模組
import urllib.request
import os
import numpy
import pandas as pd
from sklearn import preprocessing

# 下載鐵達尼旅客資料集
# 設定下載的網址
url = 'http://biostat.mc.vanderbilt.edu/wiki/pub/Main/DataSets/titanic3.xls'
# 設定下載的檔案路徑
filepath = 'titanic3.xls'
# 檢查若檔案不存在，則下載檔案
if not os.path.isfile(filepath):
    result = urllib.request.urlretrieve(url, filepath)
print('downloaded:', result)
```

meet.google.com 正在共用你的畫面。 停止共用 隱藏

Traceback (most recent call last)

<ipython-input-36-5afbef28d97a> in <module>

34°C 小雨 下午 01:30 2021/6/17

錄製 中賴政良正在分享螢幕畫面

Google Meet x Meet - bmm x (1) 蕭蕭AI人工智慧 x Dropbox - 蕭蕭 - x Home Page - Selv x Keras\_Taianic\_Intro x

localhost:8888/notebooks/Keras\_Taianic\_Introduce.ipynb

應用程式 常用連結 程式設計 發明家 第一篇 ESP32 Ardu... 通过串口连接REPL... ESP32(Arduino) @... Raspberry使用L29... 109

jupyter Keras\_Taianic\_Introduce Last Checkpoint: 2020年12月13日 (autosaved)

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3

使用Pandas dataframe讀取資料並進行處理

```
In [4]: import numpy
import pandas as pd

In [38]: all_df = pd.read_excel(filepath)

In [44]: all_df[:5]
```

Out[44]:

	pclass	survived	name	sex	age	sibsp	parch	ticket	fare	cabin	embarked	boat	body	home.dest
0	1	1	Allen, Miss. Elisabeth Walton	female	29.0000	0	0	24160	211.3375	B5	S	2	NaN	St Louis, MO
1	1	1	Allison, Master. Hudson Trevor	male	0.9167	1	2	113781	151.5500	C22 C26	S	11	NaN	Montreal, PQ / Chesterville, ON
			Allison, Miss. Helen Loraine	female	2.0000	1	2	113781	151.5500	C22 C26	S	NaN	NaN	Montreal, PQ / Chesterville, ON
0														

meet.google.com 正在共用你的畫面。 停止共用 隱藏

34°C 小雨 下午 01:33 2021/6/17

錄製 中賴政良正在分享螢幕畫面

Google Meet x Meet - bmm x (1) 蘇萊AI人工智慧 x Dropbox - 蘇萊 - x Home Page - Se... x Keras\_Taianic\_Intro... x

localhost:8888/notebooks/Keras\_Taianic\_Introduce.ipynb

應用程式 常用連結 程式設計 發明家 第一篇 ESP32 Ardu... 通过串口连接REPL... ESP32(Arduino) @... Raspberry使用L29... 109

jupyter Keras\_Taianic\_Introduce Last Checkpoint: 2020年12月13日 (unsaved changes)

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3

Run Code

0	1	1	Allen, Miss. Elisabeth Walton	female	29.0000	0	0	24160	211.3375	B5	S	2	NaN	St Louis, MO
1	1	1	Allison, Master. Hudson Trevor	male	0.9167	1	2	113781	151.5500	C22 C26	S	11	NaN	Montreal, PQ / Chesterville, ON
2	1	0	Allison, Miss. Helen Loraine	female	2.0000	1	2	113781	151.5500	C22 C26	S	NaN	NaN	Montreal, PQ / Chesterville, ON
3	1	0	Allison, Mr. Hudson Joshua Creighton	male	30.0000	1	2	113781	151.5500	C22 C26	S	NaN	135.0	Montreal, PQ / Chesterville, ON
4	1	0	Allison, Mrs. Hudson J C (Bessie Waldo Daniels)	female	25.0000	1	2	113781	151.5500	C22 C26	S	NaN	NaN	Montreal, PQ / Chesterville, ON

meet.google.com 正在共用你的畫面。 停止共用 隱藏

```
d', 'name', 'pclass', 'sex', 'age', 'sibsp', 'fare', 'embarked']  
all df=all df[cols] #選取需要的欄位, 屬於dataframe
```

34°C 小雨 下午 01:34 2021/6/17

錄製 中賴政良正在分享螢幕畫面

Google Meet x Meet - bmm x (1) 蘇嘉AI/人工智... x Dropbox - 蘇嘉 - J x Home Page - Sel... x Keras\_Taianic\_Intro... x

localhost:8888/notebooks/Keras\_Taianic\_Introduce.ipynb

應用程式 常用連結 程式設計 發明家 第一篇 ESP32 Ardu... 通过串口连接REPL... ESP32(Arduino) @... Raspberry使用L29... 109

jupyter Keras\_Taianic\_Introduce Last Checkpoint: 2020年12月13日 (unsaved changes)

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3

Run Code

4 1 0 Hudson J C (Bessie Waldo Daniels) female 25.0000 1 2 113781 151.5500 C22 C26 S NaN NaN Chesterville, ON

```
In [7]: cols=['survived','name','pclass','sex','age','sibsp',
          'parch','fare','embarked']
all_df=all_df[cols] #選取需要的欄位,置於全dataframe
```

```
In [9]: all_df[:2]
```

```
Out[9]:
```

	survived	name	pclass	sex	age	sibsp	parch	fare	embarked
0	1	Allen, Miss. Elisabeth Walton	1	female	29.0000	0	0	211.3375	S
1	1	Allison, Master. Hudson Trevor	1	male	0.9167	1	2	151.5500	S

```
In [51]: all_df.isnull().sum()
```

```
Out[51]: survived    0
name              0
pclass            0
age               0
sibsp            3
```

meet.google.com 正在共用你的畫面 · 停止共用 隱藏

34°C 小雨 下午 01:39 2021/6/17

錄製 中賴政良正在分享螢幕畫面

Google Meet x Meet - bmm x (1) 羅高AI人工智慧 x Dropbox - 羅高 x Home Page - Self x Keras\_Taiaic\_Intro x

localhost:8888/notebooks/Keras\_Taiaic\_Introduce.ipynb

應用程式 常用連結 程式設計 發明家 第一篇 ESP32 Ardu... 通过串口连接REPL... ESP32(Arduino) @... Raspberry使用L29... 109

jupyter Keras\_Taiaic\_Introduce Last Checkpoint: 2020年12月13日 (autosaved)

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3

In [17]: x\_OneHot\_df[:5]

Out[17]:

	survived	pclass	sex	age	sibsp	parch	fare	embarked_C	embarked_Q	embarked_S
0	1	1	0	29.0000	0	0	211.3375	0	0	1
1	1	1	1	0.9167	1	2	151.5500	0	0	1
2	0	1	0	2.0000	1	2	151.5500	0	0	1
3	0	1	1	30.0000	1	2	151.5500	0	0	1
4	0	1	0	25.0000	1	2	151.5500	0	0	1

轉換為array

In [75]: ndarray = x\_OneHot\_df.values

In [76]: ndarray.shape

Out[76]: (5, 10)

meet.google.com 正在共用你的畫面 停止共用 隱藏

34°C 小雨 下午 01:46 2021/6/17

Transform the data into array



錄製 中賴政良正在分享螢幕畫面

Google Meet x Meet - bmm x (1) 蘇萊AI人工智慧 x Dropbox - 蘇萊 - x Home Page - Sele x Keras\_Taianic\_Intro x

localhost:8888/notebooks/Keras\_Taianic\_Introduce.ipynb

應用程式 常用連結 程式設計 發明家 第一篇 ESP32 Ardu... 通过串口连接REPL... ESP32(Arduino) @... Raspberry使用L29... 109

jupyter Keras\_Taianic\_Introduce Last Checkpoint: 2020年12月13日 (autosaved)

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3

Run Code

```
In [2]: import urllib.request
import os

In [36]: # 匯入所需模組
import urllib.request
import os
import numpy
import pandas as pd
from sklearn import preprocessing

# 下載鐵達尼旅客資料集
# 設定下載的網址
url = 'http://biostat.mc.vanderbilt.edu/wiki/pub/Main/DataSets/titanic3.xls'
# 設定下載的檔案路徑
filepath = 'titanic3.xls'
# 檢查若檔案不存在，則下載檔案
if not os.path.isfile(filepath):
    result = urllib.request.urlretrieve(url, filepath)
print('downloaded:', result)
```

meet.google.com 正在共用你的畫面。 停止共用 隱藏

Traceback (most recent call last)

<ipython-input-36-5afbef28d97a> in <module>

34°C 小雨 下午 01:30 2021/6/17

錄製 中賴政良正在分享螢幕畫面

Google Meet x Meet - bmm x (1) 蘇萊AI人工智慧 x Dropbox - 蘇萊 x Home Page - Sel x Keras\_Taianic\_Intro x

localhost:8888/notebooks/Keras\_Taianic\_Introduce.ipynb

應用程式 常用連結 程式設計 發明家 第一篇 ESP32 Ardu... 通过串口连接REPL... ESP32(Arduino) @... Raspberry使用L29... 109

jupyter Keras\_Taianic\_Introduce Last Checkpoint: 2020年12月13日 (autosaved)

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3

Run Code

### 使用Pandas dataframe讀取資料並進行處理

```
In [4]: import numpy
import pandas as pd

In [38]: all_df = pd.read_excel(filepath)

In [44]: all_df[:5]
```

Out[44]:

	pclass	survived	name	sex	age	sibsp	parch	ticket	fare	cabin	embarked	boat	body	home.dest
0	1	1	Allen, Miss. Elisabeth Walton	female	29.0000	0	0	24160	211.3375	B5	S	2	NaN	St Louis, MO
1	1	1	Allison, Master. Hudson Trevor	male	0.9167	1	2	113781	151.5500	C22 C26	S	11	NaN	Montreal, PQ / Chesterville, ON
			Allison, Miss. Helen Loraine	female	2.0000	1	2	113781	151.5500	C22 C26	S	NaN	NaN	Montreal, PQ / Chesterville, ON
0														

meet.google.com 正在共用你的畫面。 停止共用 隱藏

34°C 小雨 下午 01:33 2021/6/17

錄製 中賴政良正在分享螢幕畫面

Google Meet x Meet - bmm x (1) 蘇萊AI人工智... x Dropbox - 蘇萊 - x Home Page - Se... x Keras\_Taianic\_Intro... x

localhost:8888/notebooks/Keras\_Taianic\_Introduce.ipynb

應用程式 常用連結 程式設計 發明家 第一篇 ESP32 Ardu... 通过串口连接REPL... ESP32(Arduino) @... Raspberry使用L29... 109

jupyter Keras\_Taianic\_Introduce Last Checkpoint: 2020年12月13日 (unsaved changes)

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3

Run Code

0	1	1	Allen, Miss. Elisabeth Walton	female	29.0000	0	0	24160	211.3375	B5	S	2	NaN	St Louis, MO
1	1	1	Allison, Master. Hudson Trevor	male	0.9167	1	2	113781	151.5500	C22 C26	S	11	NaN	Montreal, PQ / Chesterville, ON
2	1	0	Allison, Miss. Helen Loraine	female	2.0000	1	2	113781	151.5500	C22 C26	S	NaN	NaN	Montreal, PQ / Chesterville, ON
3	1	0	Allison, Mr. Hudson Joshua Creighton	male	30.0000	1	2	113781	151.5500	C22 C26	S	NaN	135.0	Montreal, PQ / Chesterville, ON
4	1	0	Allison, Mrs. Hudson J C (Bessie Waldo Daniele)	female	25.0000	1	2	113781	151.5500	C22 C26	S	NaN	NaN	Montreal, PQ / Chesterville, ON

meet.google.com 正在共用你的畫面。 停止共用 隱藏

```
d, 'name', 'pclass', 'sex', 'age', 'sibsp', 'fare', 'embarked']  
all df=all df[cols] #選取需要的欄位, 屬於dataframe
```

34°C 小雨 下午 01:34 2021/6/17

錄製 中賴政良正在分享螢幕畫面

Google Meet x Meet - bmm x (1) 蘇嘉AI/人工智... x Dropbox - 蘇嘉 - J x Home Page - Sel... x Keras\_Taianic\_Intro... x

localhost:8888/notebooks/Keras\_Taianic\_Introduce.ipynb

應用程式 常用連結 程式設計 發明家 第一篇 ESP32 Ardu... 通过串口连接REPL... ESP32(Arduino) @... Raspberry使用L29... 109

jupyter Keras\_Taianic\_Introduce Last Checkpoint: 2020年12月13日 (unsaved changes)

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3

Run Code

```
4 1 0 Hudson J female 25.0000 1 2 113781 151.5500 C22 S NaN NaN Chesterville, ON
C (Bessie Waldo Daniels)
```

```
In [7]: cols=['survived','name','pclass','sex','age','sibsp',
           'parch','fare','embarked']
        all_df=all_df[cols] #選取需要的欄位,置於至dataframe
```

```
In [9]: all_df[:2]
```

```
Out[9]:
```

	survived	name	pclass	sex	age	sibsp	parch	fare	embarked
0	1	Allen, Miss. Elisabeth Walton	1	female	29.0000	0	0	211.3375	S
1	1	Allison, Master. Hudson Trevor	1	male	0.9167	1	2	151.5500	S

```
In [51]: all_df.isnull().sum()
```

```
Out[51]: survived    0
          name       0
          pclass    0
          age       0
          sibsp     0
          parch     0
          fare      0
          embarked  0
```

meet.google.com 正在共用你的畫面 · 停止共用 隱藏

34°C 小雨 下午 01:39 2021/6/17

```

In [1]: #手寫數字辨識
        #匯入所需模組
        #數據資料的前處理
        from keras.utils import np_utils
        import numpy as np #numpy 是數值分析, as is equal to typedef
        np.random.seed(10) #10是基礎,一開始給的樹

        Using TensorFlow backend.

In [2]: from keras.datasets import mnist #讀取mnist

In [3]: (x_train_image, y_train_label), \
        (x_test_image, y_test_label) = mnist.load_data() #資料即包含測試和訓練的資料集

        Downloading data from https://s3.amazonaws.com/img-datasets/mnist.npz
        11493376/11490434 [=====] - 15s lus/step

In [4]: x_Train = x_train_image.reshape(60000, 784).astype('float32') #轉換成小數點格式
        x_Test = x_test_image.reshape(10000, 784).astype('float32')

In [5]: x_train_image.shape
        x_test_image.shape #圖形剛開始是28*28,可是類神經網路是一維的,所以要reshape成一條

Out[5]: (10000, 28, 28)

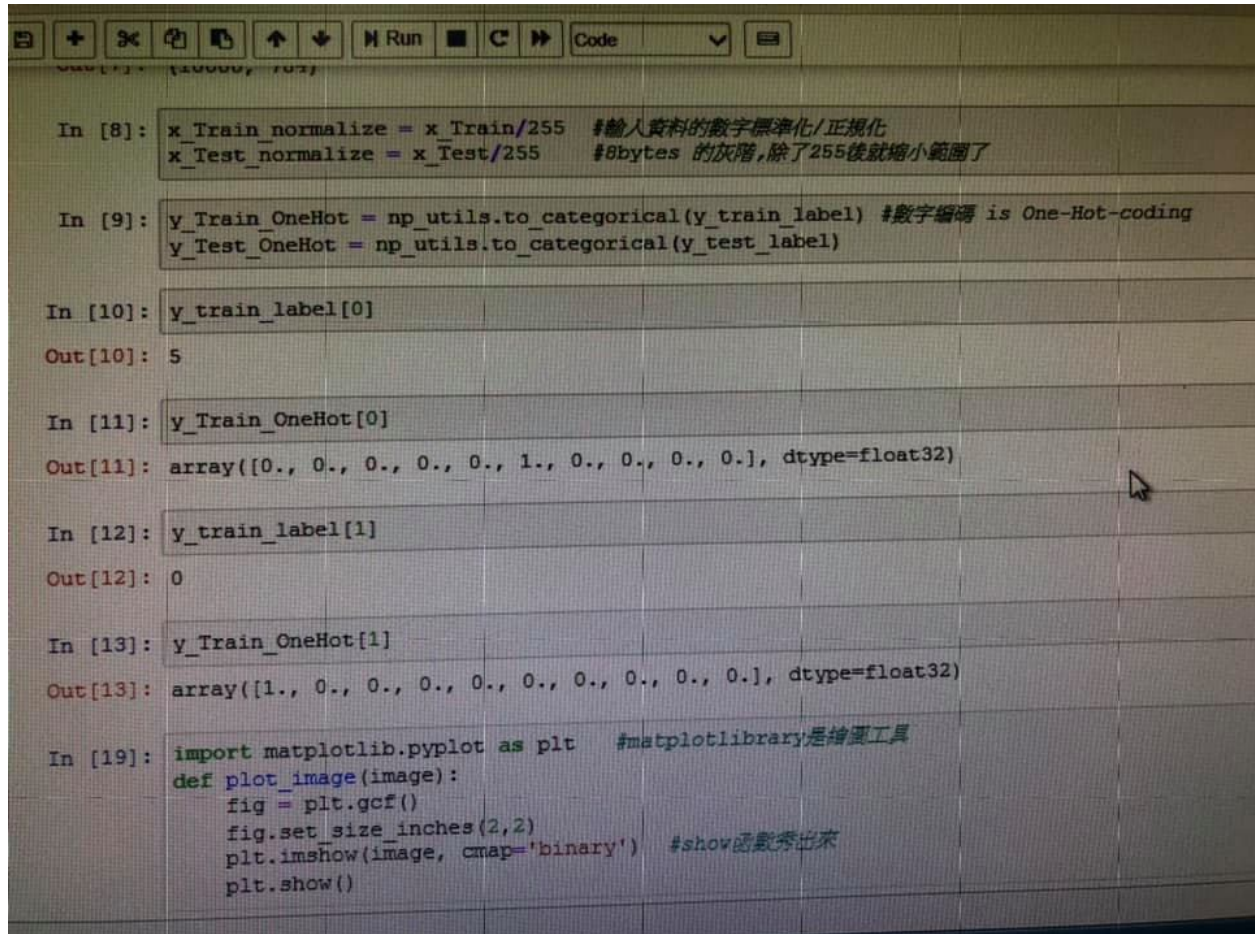
In [6]: x_Train.shape

Out[6]: (60000, 784)

```

Preprocessing: prior work to reshape the array





```
Out[7]: (10000, 784)

In [8]: x_Train_normalize = x_Train/255 #輸入資料的數字標準化/正規化
        x_Test_normalize = x_Test/255  #8bytes 的灰階,除了255後就縮小範圍了

In [9]: y_Train_OneHot = np_utils.to_categorical(y_train_label) #數字編碼 is One-Hot-coding
        y_Test_OneHot = np_utils.to_categorical(y_test_label)

In [10]: y_train_label[0]
Out[10]: 5

In [11]: y_Train_OneHot[0]
Out[11]: array([0., 0., 0., 0., 0., 1., 0., 0., 0., 0.], dtype=float32)

In [12]: y_train_label[1]
Out[12]: 0

In [13]: y_Train_OneHot[1]
Out[13]: array([1., 0., 0., 0., 0., 0., 0., 0., 0., 0.], dtype=float32)

In [19]: import matplotlib.pyplot as plt #matplotliblibrary是繪圖工具
        def plot_image(image):
            fig = plt.gcf()
            fig.set_size_inches(2,2)
            plt.imshow(image, cmap='binary') #show圖表秀出來
            plt.show()
```

The screenshot displays a Jupyter Notebook environment. The top menu bar includes File, Edit, View, Insert, Cell, Kernel, and Help. Below the menu is a toolbar with icons for saving, adding, deleting, and running code. The code cell contains the following Python code:

```
In [18]: y_Training_OneHot = np_utils.to_categorical(y_training_label) #數字編碼
          y_Testing_OneHot = np_utils.to_categorical(y_testing_label) #One-Hot-coding
```

The output of the code is displayed below the code cell:

```
Out[18]:
0.      , 0.      , 0.      , 0.      , 0.      ,
0.      , 0.      , 0.      , 0.3372549 , 0.99215686 ,
0.88235295, 0.      , 0.      , 0.      , 0.      ,
0.      , 0.      , 0.44705883, 0.93333334, 0.99215686 ,
```

The code cell also shows the following code:

```
In [19]: y_training_label[0]
```

The output of the code is displayed below the code cell:

```
Out[19]: 5
```

The code cell also shows the following code:

```
In [20]: y_Training_OneHot[0]
```

The output of the code is displayed below the code cell:

```
Out[20]: array([0., 0., 0., 0., 0., 1., 0., 0., 0., 0.], dtype=float32)
```

The code cell also shows the following code:

```
In [21]: y_training_label[1]
```

The output of the code is displayed below the code cell:

```
Out[21]: 0
```

The code cell also shows the following code:

```
In [22]: y_Training_OneHot[1]
```

The output of the code is displayed below the code cell:

```
Out[22]: array([1., 0., 0., 0., 0., 0., 0., 0., 0., 0.], dtype=float32)
```

The code cell also shows the following code:

```
In [ ]:
```

```
File Edit View Insert Cell Kernel Help
+ × ↺ ↻ ⬆ ⬇ ⬆ ⬇ Run ⬇ ⬇ Code ⬇ ⬇

In [10]: x_Training.shape
Out[10]: (60000, 784)

In [15]: x_Testing.shape
Out[15]: (10000, 784)

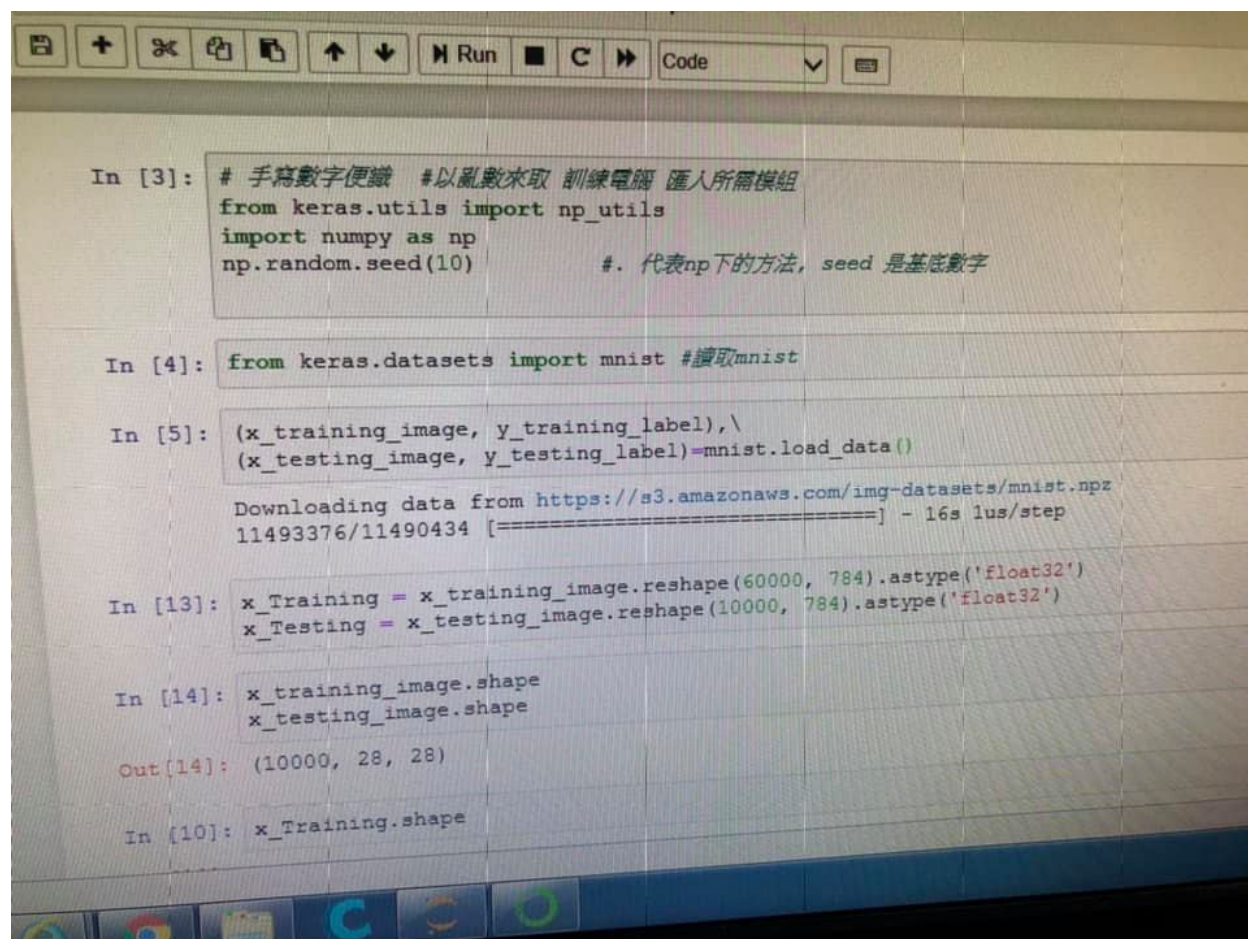
In [16]: x_Training_normalize = x_Training/255 #數字標準化
         x_Testing_normalize = x_Testing/255

In [17]: x_Training_normalize[1,:]
```

0.	0.	0.	0.	0.
0.	0.	1.	0.99215686,	0.76862746,
0.	0.	0.	0.	0.
0.	0.	0.	0.	0.
0.	0.29803923,	0.9647059,	0.9882353,	0.4392157,
0.	0.	0.	0.	0.
0.	0.	0.	0.	0.
0.99215686,	0.9882353,	0.5803922,	0.	0.
0.	0.	0.	0.	0.
0.	0.	0.	0.	0.33333334,
0.9882353,	0.9019608,	0.09803922,	0.	0.
0.	0.	0.	0.	0.
0.	0.02745098,	0.5294118,	0.99215686,	0.7294118,
0.04705882,	0.	0.	0.	0.
0	0	0	0	0

Taskbar icons: Edge, Chrome, File Explorer, VS Code, Jupyter Notebook, Task View.





The image shows a Jupyter Notebook interface with a toolbar at the top containing icons for file operations, navigation, and execution. The notebook contains several code cells. The first cell (In [3]) imports necessary modules and sets a random seed. The second cell (In [4]) imports the MNIST dataset. The third cell (In [5]) loads the data, with a progress bar and download speed information shown below the code. The fourth cell (In [13]) reshapes the training and testing images. The fifth cell (In [14]) prints the shapes of the training and testing images, with the output (10000, 28, 28) displayed below. The sixth cell (In [10]) prints the shape of the training data.

```
In [3]: # 手寫數字辨識 #以亂數來取 訓練電腦 匯入所需模組
from keras.utils import np_utils
import numpy as np
np.random.seed(10)          #. 代表np下的方法, seed 是基底數字

In [4]: from keras.datasets import mnist #讀取mnist

In [5]: (x_training_image, y_training_label), \
(x_testing_image, y_testing_label)=mnist.load_data()

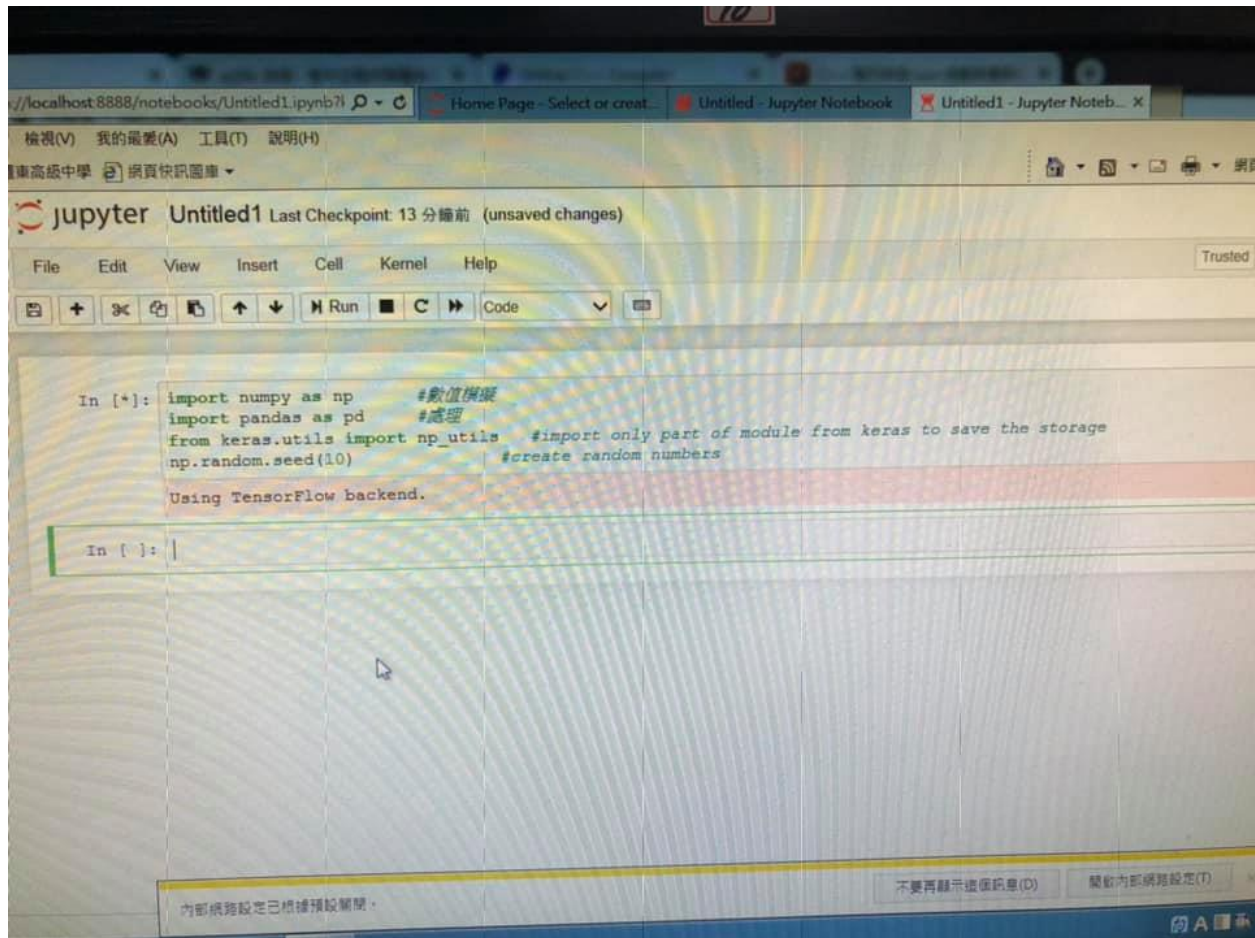
Downloading data from https://s3.amazonaws.com/img-datasets/mnist.npz
11493376/11490434 [=====] - 16s 1us/step

In [13]: x_Training = x_training_image.reshape(60000, 784).astype('float32')
x_Testing = x_testing_image.reshape(10000, 784).astype('float32')

In [14]: x_training_image.shape
x_testing_image.shape

Out[14]: (10000, 28, 28)

In [10]: x_Training.shape
```



Four main modules we used at the time